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Commentary

Short Note on Catalysts and its Mechanism

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DESCRIPTION

Catalysts are substances that change the rate of reaction by changing the reaction path. Most often, a catalyst is used to accelerate or increase the reaction rate. However, if we go to a deeper level, catalysts are used to break or rebuild chemical bonds between atoms present in the molecules of different elements or compounds. Essentially, catalysts encourage molecules to react, making the entire reaction process easier and more efficient.

Properties of catalysts

- A catalyst does not initiate a chemical reaction.
- Catalysts tend to react with reactants to form intermediates while facilitating the production of the final reaction product.
- After the whole process, the catalyst can be regenerated.
- A catalyst can be a solid, liquid, or gaseous. Some of the solid catalysts include metals or their oxides, including sulphides and halides. Semimetallic elements such as boron, aluminum, and silicon are also used as catalysts. Likewise, liquid and gaseous elements are used in their pure form as catalysts.

Sometimes these elements are also used in conjunction with suitable solvents or vehicles. The reaction that a catalyst participates in its system is called a catalytic reaction. In other words, catalytic action is a chemical reaction between the catalyst and a reactant. This leads to the formation of chemical intermediates that can more easily react with each other or with another reactant to form a product. As reactants occur, the catalyst is regenerated. The modes of reaction between the catalysts and the reactants are usually very different and more complex in the case of solid catalysts.

The reactions can be acid-base reactions, oxidation-reduction reactions, the formation of coordination complexes or the generation of free radicals. For solid catalysts, the reaction mechanism is strongly influenced by surface properties and electronic or crystal structures. Some types of solid catalysts, such as poly functional catalysts, can exhibit multiple modes of reaction with reactants. There are several types of catalysts that can be used based on the requirements or needs of the chemical reaction. They are as follows:

Positive catalysts

Catalysts that increase the rate of a chemical reaction are known as "positive catalysts." It increases the reaction rate by lowering the activation energy barriers so that a large number of reaction molecules are converted into products, thereby increasing the percentage yield of products. The best example of a positive catalyst is the production of NH_3 using the Haber process. Iron oxide acts as a positive catalyst and increases the ammonia yield despite the lower nitrogen reaction.

Negative catalysts

Catalysts that slow down the reaction rate are known as "negative catalysts." It slows the reaction rate by raising the activation energy barrier, which reduces the number of reactive molecules that need to be converted into products and thus slows the reaction rate. The best example of a negative catalyst the decomposition of hydrogen peroxide into water and oxygen is retarded by the use of acetanilide, which acts as a negative catalyst to slow the rate of decomposition of hydrogen peroxide.

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